What is claimed is:

1. A hologram recording medium which is made of a photo refractive crystal of a uniaxial crystal having surfaces in a shape of parallel flat plates and has a plurality of areas of a refractive index grating corresponding to one portion of a three-dimensional light interference pattern of a coherent signal light beam and coherent reference light of a first wavelength modulated in accordance with information data, wherein each of the areas of said refractive index grating has a columnar shape, and the areas of said refractive index grating are adjacently arranged in parallel with each other.

2. A hologram recording medium according to claim 1, wherein the photo refractive crystal is a crystal having a recording sensitivity at said first wavelength that increases when a gate light beam of a second wavelength is simultaneously irradiated in addition to the reference light and the signal light of said first wavelength.

3. A hologram recording medium according to claim 1, wherein the photo refractive crystal has an optical crystal axis approximately parallel or perpendicular to a main surface of the recording medium.

4. A hologram recording medium according to claim 1, wherein information data of one screen are stored in areas of said refractive index grating.

5. A hologram recording medium according to claim 1, wherein each of the areas of said refractive index grating of the columnar shape extends approximately perpendicularly to the

main surface of the hologram recording medium.

6. A hologram recording medium according to claim 1, wherein each of the areas of said refractive index grating of the columnar shape approximately has a cylindrical shape.

7. A hologram recording medium according to claim 1, wherein a maximum inside diameter of the areas of said refractive index grating is smaller than the distance between peaks of zeroth-order and primary diffracted lights of a light intensity distribution of said signal light beam.

8. A hologram recording method for forming a plurality of areas of a refractive index grating corresponding to one portion of a three-dimensional light interference pattern of a coherent signal light beam and coherent reference light of a first wavelength modulated in accordance with information data within a recording medium made of a photo refractive crystal of a uniaxial crystal having a parallel flat plate shape, wherein said signal light beam and the recording reference light beam cross each other within said recording medium, and a gate light beam having a second wavelength for revealing recording sensitivity of said recording medium is simultaneously irradiated to said recording medium so as to pass through a portion of the recording medium for crossing said signal light beam and the recording reference light beam and demarcate a volume smaller than that of this crossing portion.

9. A hologram recording method according to claim 8, wherein said gate light beam is converged and said recording medium

is arranged in the vicinity reaching a waist of this gate light beam, and the areas of said refractive index grating are formed in a columnar shape and are adjacently arranged in parallel with each other.

10. A hologram recording method according to claim 8, wherein said recording medium has an optical crystal axis approximately parallel or perpendicular to a main surface of the recording medium.

11. A hologram recording method according to claim 8, wherein said recording reference light beam and said gate light beam are coaxially irradiated.

12. A hologram recording method according to claim 8, wherein said recording reference light beam is converged.

13. A hologram recording method according to claim 8, wherein said recording reference light beam and said gate light beam are approximately perpendicularly irradiated to a main surface of said recording medium, and the areas of said refractive index grating of the columnar shape extend approximately perpendicularly to the main surface of said recording medium.

14. A hologram recording method according to claim 8, wherein the gate light beam and the signal light beam are respectively irradiated such that a cross sectional area of said gate light beam on the surface of said recording medium is smaller than that of said signal light beam.

15. A hologram recording method according to claim 8, wherein each of the areas of said refractive index grating of

the columnar shape is approximately formed in a cylindrical shape.

16. A hologram recording method according to claim 8, wherein a maximum inside diameter of the areas of said refractive index grating is smaller than the distance between peaks of zeroth-order and primary diffracted lights of a light intensity distribution of said signal light beam.

17. A hologram recording and reproducing apparatus for forming a plurality of areas of a refractive index grating corresponding to one portion of a three-dimensional light interference pattern of a coherent signal light beam and coherent reference light of a first wavelength modulated in accordance with information data within a recording medium made of a photo refractive crystal of a uniaxial crystal having a parallel flat plate shape,

said hologram recording and reproducing apparatus comprising:

a supporting part for detachably holding the recording medium made of the photo refractive crystal having the parallel flat plate shape;

a reference light part for making a coherent recording reference light beam of a first wavelength approximately perpendicularly incident to a main surface of said recording medium;

a signal light part for making the coherent signal light beam of the first wavelength modulated in accordance with the information data of one screen incident to said

recording medium, and making the coherent signal light beam cross said recording reference light beam within the recording medium, and generating a light interference pattern of said signal light beam and the recording reference light beam;

a gate light part for making a gate light beam of a second wavelength for revealing recording sensitivity of the recording medium approximately perpendicularly incident to the main surface of said recording medium together with said recording reference light beam, and forming a refractive index grating of one portion of said light interference pattern which passes through a portion of said recording medium for crossing said signal light beam and the recording reference light beam and demarcates a volume smaller than that of this crossing portion;

a phase conjugate wave generating part for generating a phase conjugate wave with respect to said signal light beam by irradiating a reproducing reference light beam coaxial with respect to said recording reference light beam and propagated in an opposite direction to said refractive index grating of said recording medium;

a separating part for separating said phase conjugate wave from an optical path of said signal light beam; and

a detecting part for detecting the information data formed as an image by said phase conjugate wave.

18. A hologram recording and reproducing apparatus according to claim 17, wherein the hologram recording and reproducing

apparatus further comprises a part for converging said gate light beam and said recording medium is arranged in the vicinity reaching a waist of said gate light beam, and the areas of said refractive index grating are formed in a columnar shape and are adjacently arranged in parallel with each other.

19. A hologram recording and reproducing apparatus according to claim 17, wherein said recording medium has an optical crystal axis approximately parallel or perpendicular to a main surface of the recording medium.

20. A hologram recording and reproducing apparatus according to claim 17, wherein the hologram recording and reproducing apparatus further comprises a part for coaxially irradiating said recording reference light beam and said gate light beam.

21. A hologram recording and reproducing apparatus according to claim 17, wherein the hologram recording and reproducing apparatus further comprises a part for converging said recording reference light beam.

22. A hologram recording and reproducing apparatus according to claim 17, wherein said recording reference light beam and said gate light beam are approximately perpendicularly irradiated to a main surface of said recording medium, and the areas of said refractive index grating of the columnar shape are approximately perpendicularly extended to the main surface of said recording medium.

23. A hologram recording and reproducing apparatus according to claim 17, wherein the gate light beam and the signal light

beam are respectively irradiated such that a cross sectional area of said gate light beam on the surface of said recording medium is smaller than that of said signal light beam.

24. A hologram recording and reproducing apparatus according to claim 17, wherein each of the areas of said refractive index grating of the columnar shape is approximately formed in a cylindrical shape.

25. A hologram recording and reproducing apparatus according to claim 17, wherein a maximum inside diameter of the areas of said refractive index grating is smaller than the distance between peaks of zeroth-order and primary diffracted light beams of a light intensity distribution of said signal light beam.

26. A hologram recording and reproducing method for recording and reproducing information using a hologram comprising:

a recording step including the steps of;

providing a recording medium made of a photo-refractive crystal of a uniaxial crystal having a shape of parallel flat plates;

converging a coherent recording reference light beam onto said recording medium arranged at an upstream side and in a vicinity of a beam waist of the recording reference light beam passing there through in such manner that said recording reference light beam is irradiated to a main surface of said recording medium; and

converging a coherent signal light beam of a first

wavelength modulated in accordance with information data onto said recording medium to intersect with the recording reference light beam within said recording medium to form a region of the refractive index grating in a columnar shape extended from the main surface of said recording medium, so that a plurality of the regions of the refractive index grating can be adjacently arranged in parallel with each other correspondingly to a portion of a three-dimensional optical interference pattern of the signal light beam and the reference light beam; and

a reproducing step including the steps of;

converging and passing the recording reference light beam to the main surface of said recordin medium; and

reflecting the recording reference light beam at the beam waist or its vicinity thereof to generate a reproducing reference light beam coaxial with the recording reference light beam going back to said recording medium to propagate the reproducing reference light beam in an opposite direction into said refractive index grating of said recording medium to generate a phase conjugate wave.

27. A hologram recording and reproducing method according to claim 26, wherein a gate light beam having a second wavelength for enhancing a recording sensitivity of said recording medium is irradiated to said recording medium coaxially with respect to said recording reference light beam so as to pass through a portion of the recording medium for crossing said signal light beam and the recording reference

light beam and demarcate a volume smaller than that of said portion for crossing said signal light beam and the recording reference light beam in said recording step.

28. A hologram recording and reproducing method according to claim 26, wherein said recording medium has an optical crystal axis approximately parallel or perpendicular to the main surface of the recording medium.

29. A hologram recording and reproducing method according to claim 27, wherein the light beams are respectively irradiated such that a cross sectional area of said gate light beam or said recording reference light beam on a surface of said recording medium is smaller than that of said signal light beam.

30. A hologram recording and reproducing method according to claim 27, wherein each of the areas of said refractive index grating of the columnar shape is approximately formed in a cylindrical shape.

31. A hologram recording and reproducing method according to claim 26, wherein a maximum inside diameter of the areas of said refractive index grating is smaller than the distance between peaks of zeroth-order and primary diffracted lights of a light intensity distribution of said signal light beam.

32. A hologram recording and reproducing apparatus for forming plural areas of a refractive index grating corresponding to one portion of a three-dimensional optical interference pattern of a coherent signal light beam and coherent reference light of a first wavelength modulated in

accordance with information data within a recording medium constructed by a photo-refractive crystal of a uniaxial crystal having a parallel flat plate shape, said hologram recording and reproducing apparatus comprising:

a supporting part for detachably holding the recording medium constructed by the photo-refractive crystal having the parallel flat plate shape;

a reference light part for making a coherent recording reference light beam of the first wavelength convergent and approximately perpendicularly incident to a main surface of said recording medium;

a signal light part for making the coherent signal light beam of the first wavelength modulated in accordance with the information data of one screen incident to said recording medium, and making the coherent signal light beam cross said recording reference light beam within the recording medium, and generating a optical interference pattern of said signal light beam and the recording reference light beam;

a gate light part for making a gate light beam of a second wavelength for enhancing a recording sensitivity of the recording medium convergent and approximately perpendicularly incident to the main surface of said recording medium coaxially with respect to said recording reference light beam, and forming the refractive index grating of one portion of said optical interference pattern which passes through a portion of said recording medium for

crossing said signal light beam and the recording reference light beam and demarcates a volume smaller than that of this crossing portion;

a phase conjugate wave generating part which includes a plane mirror arranged in the vicinity of a beam waist of said recording reference light approximately perpendicularly incident to the main surface of said recording medium, and generates a phase conjugate wave with respect to said signal light beam by irradiating a reproducing reference light beam coaxial with respect to said recording reference light beam and propagated in an opposite direction to said refractive index grating of said recording medium by said plane mirror;

a separating part for separating said phase conjugate wave from an optical path of said signal light beam; and

a detecting part for detecting the information data formed as an image by said phase conjugate wave.

33. A hologram recording and reproducing apparatus according to claim 32, wherein said supporting part has a moving mechanism for moving said recording medium such that the areas of said refractive index grating are formed in a columnar shape and are adjacently arranged in parallel with each other.

34. A hologram recording and reproducing apparatus according to claim 32, wherein said recording medium has an optical crystal axis approximately parallel or perpendicular to the main surface of the recording medium.

35. A hologram recording and reproducing apparatus according

to claim 32, wherein the gate light beam and the signal light beam are respectively irradiated such that a cross sectional area of said gate light beam on the surface of said recording medium is smaller than that of said signal light beam.

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